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ASSESSMENT AND TREATMENT OF DESTRUCTIVE BEHAVIOR MAINTAINED BY STEREOTYPIC OBJECT MANIPULATION

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In the current investigation, 2 participants with mental retardation displayed property destruction and stereotypy, and both responses involved the same materials (e.g., breaking and tapping plastic objects). Three experiments were conducted (a) to indirectly assess the functions of these two responses, (b) to determine their relation to one another, and (c) to develop a treatment to reduce the more serious behavior, property destruction. In Experiment 1, previously destroyed materials were either present or absent, and their presence reduced property destruction but not stereotypy. In Experiment 2, matched toys (ones that produced sensory stimulation similar to stereotypy) were either present or absent, or were replaced by unmatched toys (for 1 participant). Matched toys produced large reductions and unmatched toys produced small reductions in property destruction and stereotypy. In Experiment 3, attempts to pick up undestroyed objects were either blocked or not blocked while matched toys were continuously available. Response blocking reduced property destruction (and attempts), prevented stereotypy, and increased manipulation of matched toys. These results suggest that the two aberrant responses formed a chain (e.g., breaking and then tapping the object), which was maintained by the sensory consequences (e.g., auditory stimulation) of the terminal response, and that previously destroyed material or matched toys made the initial response (property destruction) unnecessary.

DESCRIPTORS: automatic reinforcement, functional analysis, property destruction, stereotypy

Individuals with mental retardation who display one form of aberrant behavior (e.g., self-injury) often display other forms (e.g., aggression, self-restraint, stereotypy) as well (Griffin, Williams, Stark, Altmeyer, & Mason, 1986; Maurice & Trudel, 1982; Powell, Bodfish, Parker, Crawford, & Lewis, 1996; Sigafoos, Elkins, Kerr, & Attwood, 1994). However, explanations of why aberrant behaviors tend to co-occur remain somewhat speculative because most studies on response–response relations have used correlational methods (e.g., Aman, Singh, Stewart, & Field, 1985; Griffin et al.). Studies using functional analysis methods may provide more direct tests of operant hypotheses regarding response–response relations.

One operant explanation for covariation among aberrant responses is that the behaviors belong to the same operant class (i.e., they are maintained by the same reinforcement). For example, Smith, Iwata, Vollmer, and Pace (1992) observed that self-injurious behavior (SIB) and self-restraint appeared to be maintained by escape from nonpreferred tasks, whereas Derby, Fisher, and Piazza (1996) found that SIB and self-restraint were both maintained by contingent attention. Finally, Lalli, Mace, Wohn, and Livezey (1995) found that screaming, aggression, and SIB were maintained by escape from de-

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mands and that the three responses tended to occur in a hierarchical sequence. That is, screaming was evoked by the presentation of demands, aggression was evoked primarily when screaming failed to produce escape from demands, and SIB was evoked primarily when both screaming and aggression failed to produce escape from demands. These case examples provide empirical evidence showing that topographically distinct responses may sometimes be correlated because they are members of a common operant class.

Another way in which two responses may be related is that one response may alter the probability of reinforcement for the other one. For example, Skinner (1957) proposed that a speaker may alter the probability that a listener will reinforce a mand (an operant that specifies its reinforcer) through either positive reinforcement (e.g., saying "bless you") or negative reinforcement (e.g., following through on the threat, "Give me food or else!"). Bowman, Fisher, Thompson, and Piazza (1997) showed that mands and destructive behavior are sometimes related in this manner. Their participants displayed a variety of mands (requests for reinforcers expressed vocally) and emitted destructive behavior primarily when these requests were *not* reinforced. Caregivers could avoid destructive behavior by reinforcing the participant's mands. Thus, mands functioned to produce a wide variety of requested reinforcers, and the function of destructive behavior was to increase the likelihood that all or almost all requests would produce reinforcement.

A third way in which two responses may be related is that one response may function as reinforcement or punishment for another one (e.g., Hundt & Premack, 1963; Konarski, Johnson, Crowell, & Whitman, 1980; Premack, 1962; Terhune & Premack, 1970). Results from several investigations suggest that avoidance or termination of the painful consequences of SIB may function as negative reinforcement for self-restraint (Fisher, Grace, & Murphy, 1996; Silverman, Watanabe, Marshall, & Baer, 1984; Smith et al., 1992) or, conversely, that access to self-restraint may function as positive reinforcement for SIB (Smith, Lerman, & Iwata, 1996).

Fisher, Adelinis, Thompson, Worsdell, and Zarcone (1998) suggested that a variety of aberrant responses (e.g., self-restraint, stereotypies, rituals, pica) that persist in the absence of social contingencies may be maintained by automatic reinforcement. These responses, in turn, may function as reinforcement for other aberrant behaviors (e.g., aggression, SIB). For example, suppose that an individual displays pica that is maintained by automatic reinforcement (e.g., oral stimulation). Caregivers may attempt to prevent or decrease this response by blocking it. Blocking pica may produce other behavior typically evoked by extinction, such as aggression. Caregivers may discontinue blocking and allow the individual to resume pica when aggression occurs. Resumption of pica, in turn, may function as positive reinforcement for aggression. It is well established that contingent access to a high-probability response can function as positive reinforcement for another response (e.g., Premack, 1962). Additional research is needed to test the hypothesis that high-probability aberrant responses that persist in the absence of social contingencies (e.g., pica) sometimes function as reinforcement for other aberrant responses (e.g., aggression). Methods similar to the ones applied by Smith et al. (1996) and Fisher et al. (1998) might be used with individuals who display emotional or destructive behavior (e.g., tantrums, aggression, SIB) primarily when high-probability aberrant responses (e.g., stereotypies, pica) are interrupted.

In the studies by Smith et al. (1996) and Fisher et al. (1998), the contingency be-

tween the high-probability response (e.g., self-restraint, stereotypy) and the other aberrant response (e.g., SIB, aggression) was socially mediated (i.e., the experimenters interrupted and allowed access to the high-probability response). In the current investigation, each participant displayed a high-probability stereotypic response (i.e., string play, repetitive tapping) across environmental contexts and a lower probability but more troublesome aberrant behavior (i.e., property destruction) primarily when the participant was alone. We believed that the two responses might be related because each behavior involved the same materials. That is, the materials that were destroyed were subsequently incorporated into the stereotypic responses (i.e., ripping curtains into shreds and then using them for string play, breaking and then tapping objects). We hypothesized that the function of property destruction was to provide preferred materials for stereotypic behavior. The current investigation was designed to test this hypothesis and to develop an effective treatment that could be employed in situations in which the participants were alone or minimally supervised.

GENERAL METHOD

Participants and Setting

Two individuals who had been admitted to an inpatient unit specializing in the assessment and treatment of severe behavior problems participated. Milo was a 7-year-old boy who had been diagnosed with moderate mental retardation, pervasive developmental disorder, and a speech and language delay. He could follow two-step instructions and communicated with a few signs. His primary target behavior was property destruction (e.g., breaking mini blinds, plastic toys, hangers). Morris was a 15-year-old boy who had been diagnosed with autism. He could follow two-step directions and communicated through gestures and a few signs. Property destruction was the primary target response for both participants. All sessions were conducted in a room (3 m by 3 m) equipped with a one-way mirror.

Data Collection and Interrater Agreement

Trained observers recorded target responses on laptop computers. Milo's target responses were property destruction, attempted property destruction, and stereotypy. *Property destruction* was defined as physically breaking one object into two pieces. A *property destruction attempt* was defined as physically touching an object (excluding toys). *Stereotypy* was defined as tapping an object (other than a toy) against walls, floors, furniture, objects, or body parts. Stereotypy often occurred in bursts (rapid and repeated taps). A separate response was scored only if 2 s had elapsed since the last tap. Milo manipulated toys in a manner similar to other objects (he tapped them). Therefore, toy manipulation was scored using the same criteria as stereotypy. That is, single taps or bursts of taps using toys were scored as toy manipulation if they were separated by at least 2 s.

For Morris, *property destruction* was defined as ripping a piece of material. Bursts of ripping were scored as a single response unless at least 2 s had elapsed since the last rip. *Stereotypy* was defined as touching or manipulating string-like pieces of material (e.g., twisting material or winding it around his fingers or arms). Because these responses often occurred for extended periods of time, stereotypy was scored as a duration measure for Morris. Toy contact was defined as touching, holding, or manipulating a toy and also was scored as a duration measure for Morris.

Two observers simultaneously but independently recorded target responses during more than 50% of the sessions in each experiment. Across sessions in all three exper-

iments, the mean agreement coefficients for property destruction were 96.1% (range, 73.7% to 100%) and 93.5% (range, 74% to 100%) for Milo and Morris, respectively. Mean agreement coefficients for stereotypy were 86.8% (range, 70.5% to 100%) for Milo and 85.5% (range, 23% to 100%) for Morris. The mean agreement coefficients for toy play were 94.8% (range, 72.1% to 100%) for Milo and 86% (range, 21% to 100%) for Morris. Mean agreement coefficient for Milo's property destruction attempts was 96.6% (range, 85.2% to 100%).

EXPERIMENT 1

Behavioral Persistence and Noncontingent Destruction

Experiment 1 was designed to assess two hypotheses: that stereotypy was maintained by automatic reinforcement and that the function of property destruction was to provide participants with preferred materials for stereotypy. That is, Experiment 1 examined whether both responses persisted in the absence of social contingencies (first hypothesis) and whether property destruction would decrease in a condition in which "destroyed" materials (i.e., ones the participants had previously ripped or broken) were noncontingently available (second hypothesis). If the second hypothesis was correct, then the availability of previously destroyed materials should eliminate the establishing operation for property destruction (Michael, 1993).

Method

Experiment 1 was conducted using a reversal design (ABAB). Each session was 10 min in length, and approximately 6 to 10 sessions were completed per day. During baseline, the participant was alone in the session room. The room was baited with materials similar to those the participant reportedly destroyed at home (plastic items for Milo; paper and cloth items for Morris). During the noncontingent destruction (NCD) condition, the participant was alone in the session room with the same (unbroken) materials that were present during baseline, and previously destroyed materials were added (i.e., ones the participants had ripped or broken prior to the session). That is, baseline and NCD were identical with one exception: Unbroken materials were present in baseline, and both broken and unbroken items were present during NCD.

Results and Discussion

Results for Milo are presented in the top panel of Figure 1. The mean rate of property destruction was 1.8 responses per minute (range, 1.2 to 2.3) in the initial baseline. Property destruction decreased to 0.5 responses per minute (range, 0.4 to 0.6) when previously destroyed materials were freely available during the first NCD phase, increased in the second baseline to 1.2 responses per minute (range, 0.8 to 1.4), and decreased during the final NCD phase to a mean rate of 0.2 responses per minute (range, 0 to 0.7) and remained at zero for the last four sessions. Milo displayed fairly constant rates of stereotypy across phases and conditions (M = 4.0 and 4.2 responses per minute in baseline and 4.4 and 5.2 responses per minute during NCD, respectively). Finally, within-session analyses showed that property destruction tended to be much more probable in the 1st min of the session during baseline phases (M = 7.2 responses per minute during the 1st min and 1.2 responses per minute during the remaining 9 min across baseline sessions), whereas stereotypy was much less probable (M = 0.8 responses per minute during the 1st min and 4.4 responses per minute during the remaining 9 min).

Results for Morris are presented in the bottom panel of Figure 1. Property destruction occurred at somewhat variable rates during the initial baseline (M = 2.9 respons-

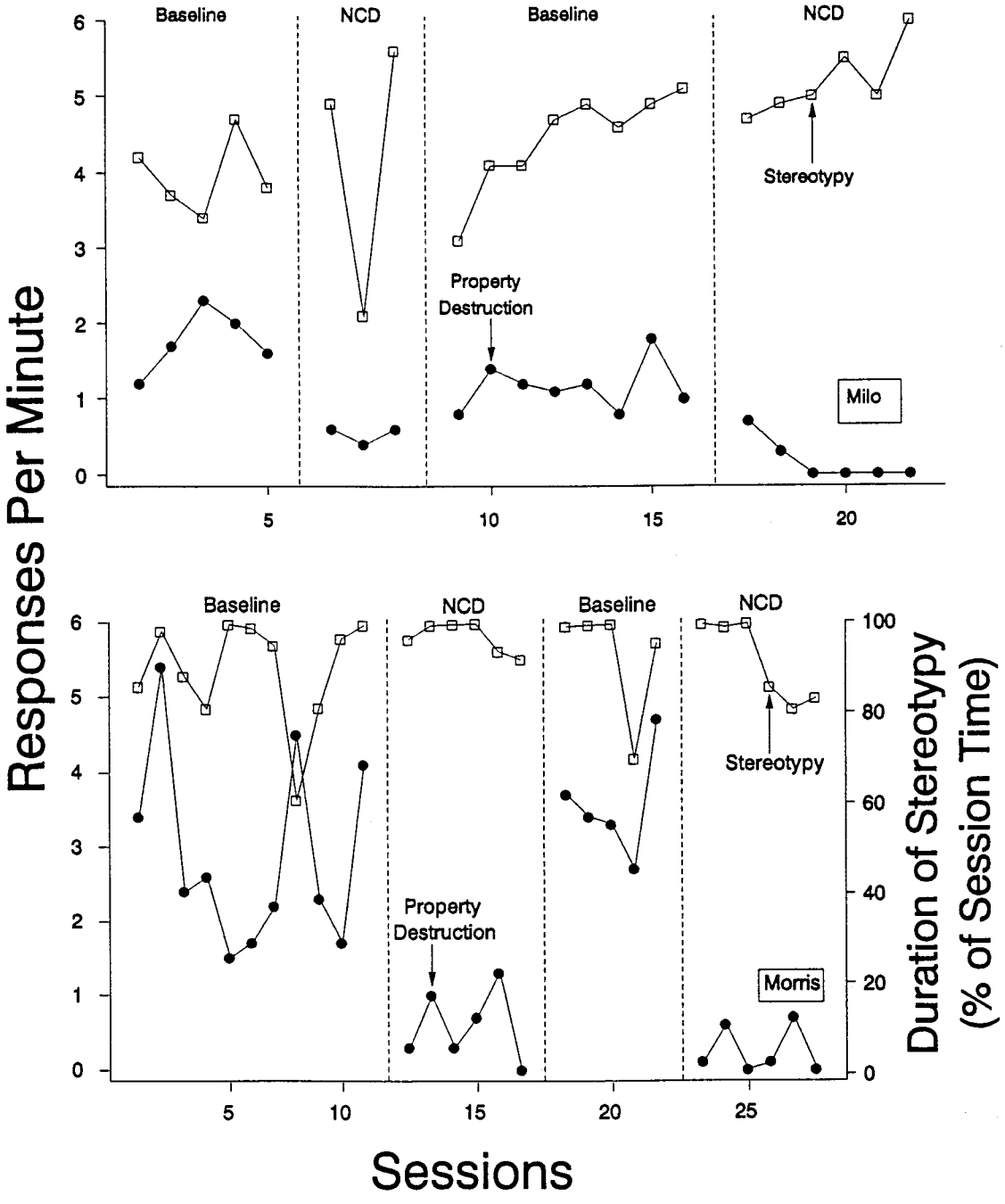

Figure 1. Levels of property destruction and stereotypy during baseline and noncontingent destruction (NCD) for Milo (top panel) and Morris (bottom panel).

es per minute; range, 1.5 to 5.4), decreased markedly when previously destroyed materials were added in the first NCD phase (M = 0.6 responses per minute; range, 0 to 1.3), increased during the second baseline to levels slightly higher and more stable than

during the first baseline (M = 2.9 responses per minute; range, 2.7 to 4.7), and decreased in the final NCD phase to 0.3 responses per minute (range, 0 to 0.7). Morris, like Milo, displayed high and fairly stable levels of stereotypy across phases and conditions (M = 89% and 97% of the session time in baseline and 93% and 91% during NCD, respectively). Finally, within-session analyses showed that property destruction was slightly more probable in the 1st min of the session during baseline phases (M = 3.5 responses per minute during the 1st min and 2.8 responses per minute during the remaining 9 min across baseline sessions), whereas stereotypy was somewhat less probable (M = 65% of the 1st min and 91% of the remaining 9 min). It should be noted that, for both participants, the room was baited with a sufficient amount of unbroken materials such that property destruction was readily available throughout all baseline and NCD sessions (i.e., the participants did not come close to running out of materials to destroy).

Results for both participants clearly showed that stereotypy and property destruction persisted in the absence of social consequences during baseline. These results support the hypothesis that both responses were maintained by automatic reinforcement. The fact that property destruction decreased during NCD also supports the hypothesis that this response was maintained by access to the materials used for stereotypy. That is, if property destruction per se produced a reinforcing consequence independent of stereotypy (e.g., the tactile feel or sound of ripping or breaking), then the availability of previously destroyed objects should have had no effect on the probability of property destruction. By contrast, if its function was to produce preferred materials for stereotypy, then property destruction should have decreased when such materials were noncontingently available, which is what occurred.

EXPERIMENT 2

Evaluation of "Matched" Toys

Another approach to assessing the function of a response that persists in the absence of social contingencies is to evaluate the extent to which "matched" stimuli serve as effective substitute reinforcers. Matched stimuli are ones that, when manipulated by the participant, produce sensory consequences similar to those produced automatically by the target response (e.g., Favell, McGimsey, & Schell, 1982; Piazza et al., 1998; Rincover, Cook, Peoples, & Packard, 1979). In behavioral economics terms (Green & Freed, 1993), matched stimuli are considered to be effective substitute reinforcers if their consumption reduces the target response (and, by inference, reduces consumption of its automatic reinforcer; Shore, Iwata, DeLeon, Kahng, & Smith, 1997). For example, Piazza et al. (in press) showed that noncontingent access to matched stimuli (i.e., firm, edible items that could be gnawed) reduced pica more than unmatched stimuli (i.e., other preferred edible items). We used similar methods in Experiment 2 to evaluate the effects of matched and unmatched toys on property destruction and stereotypy.

A number of investigations have shown that highly preferred stimuli, identified via a preference assessment, often compete with aberrant behavior that persists in the absence of social contingencies (Derby et al., 1995; Piazza, Fisher, Hanley, Hilker, & Derby, 1996; Ringdahl, Vollmer, Marcus, & Roane, 1997). Thus, the importance of selecting matched stimuli remains uncertain, because highly preferred but unmatched stimuli may work just as well. If the two types of stimuli work equally well, one would generally select unmatched stimuli because they may be more likely to occasion socially desirable behaviors (e.g., appropriate play), whereas matched stimuli are more likely to occasion stereotypic behavior. In Experiment 2 we at-

tempted to identify highly preferred unmatched stimuli that were most likely to compete with the sensory consequences of stereotypy. We were able to identify unmatched stimuli for Morris but not for Milo. We then compared the effects of these unmatched stimuli with matched stimuli on Morris's property destruction, stereotypy, and toy play. For Milo, the effects of matched toys were compared to baseline and, for Morris, both unmatched and matched toys were compared to baseline.

Method

Identification of unmatched and matched stimuli. Milo's parents reported that he did not interact with toys except those that he broke and tapped, which was consistent with our own observations. That is, we were unable to identify unmatched toys for Milo because he interacted with all toys in the same manner (i.e., breaking and tapping them). Therefore, we attempted to identify a number of items that shared characteristics with the items Milo usually broke and tapped (i.e., hard plastic items that made noise when tapped). We then placed Milo in a room alone with these items and selected those that he tapped. The toys selected for Milo were a colored cup, plastic and metal spoons, and plastic play tools.

The initial pool of stimuli was identified for Morris based on caregiver report using the Reinforcer Assessment for Individuals with Severe Disabilities (RAISD; Fisher, Piazza, Bowman, & Amari, 1996). The RAISD is a structured interview that is used with caregivers to generate a list of child-preferred stimuli from the following general domains: visual, auditory, olfactory, edible, social, tactile, and toys. This structured interview resulted in the identification of 16 unmatched stimuli and one matched stimulus (string). Next, two choice assessments were conducted, one using the procedures described by Fisher et al. (1992) and a second using the procedures described by Piazza et al. (1998).

In the first choice assessment, all of the unmatched stimuli were compared to each other. That is, each unmatched stimulus was presented once with every other unmatched stimulus, and Morris was allowed to choose and briefly obtain one of the two stimuli. A preference score was then calculated for each stimulus by dividing the number of times it was chosen by the number of times it was presented. Next, the eight unmatched stimuli with the highest preference scores were compared with the one matched stimulus (string) that had been identified with the RAISD. The purpose of this second choice assessment was to identify the high-preference unmatched stimuli that were most likely to compete with the sensory consequences produced through stereotypic responding with the matched stimulus (string).

During each 30-s trial, the string and one of the eight unmatched stimuli were presented concurrently, and Morris could freely interact with one, both, or neither of the items. Each unmatched stimulus was presented with the string four times (four 30-s trials). We then selected a subset of four unmatched stimuli that were highly preferred (ranked 1, 2, 3, and 5 on the first choice assessment) and were also preferred over the matched stimulus (string) during the second preference assessment (i.e., unmatched items that Morris interacted with more than he interacted with the string). The unmatched preferred stimuli selected were a puzzle, Legos™, PlayDoh™, and bubbles.

Because we wanted a variety of matched stimuli and the RAISD identified only one (i.e., string), we generated additional stimuli based on their physical similarity to string. These items included a jump rope, yo-yo, Slinky™, plastic needlepoint kit, and a weaving loom to make potholders.

Procedure. Approximately 6 to 10 sessions (10 min each) were conducted per day in a

room (3 m by 3 m) equipped with a one-way mirror. The experimental conditions were alternated within a multielement design (Sidman, 1960). During baseline, the participant was alone in the session room. The room was baited with materials similar to those the participant reportedly destroyed at home (plastic items for Milo; paper and cloth items for Morris). During the matched-toys condition, the participant was alone in the room with the same materials that were present during baseline. In addition, matched toys identified for each participant and listed above were available noncontingently only in the matched-toys condition. The unmatched-toys condition (Morris only) was identical to baseline except that the unmatched toys listed above were available noncontingently throughout the session.

Results and Discussion

Rates of property destruction during baseline, the matched-toys condition, and the unmatched-toys condition (Morris only) are presented in Figure 2. Rates of property destruction during baseline were relatively high for both Milo (M = 1.2 responses per minute; range, 0 to 2.7) and Morris (M = 1.8 responses per minute; range, 0 to 3.7). Noncontingent access to matched toys reduced the rates of Milo's property destruction (M = 0.3 responses per minute; range, 0 to 1.5); however, he periodically destroyed the baited items at levels that were clinically unacceptable (up to 1.5 responses per minute). For Morris, the matched toys reduced property destruction to near-zero levels (M = 0.1 responses per minute; range, 0 to 0.3). By contrast, the unmatched toys reduced property destruction only marginally (M = 1.2 responses per minute; range, 0.2 to 2.4).

The effects of noncontingent access to matched toys and unmatched toys (Milo only) on stereotypy (not shown in Figure 2) were similar to those for property destruction. In baseline, stereotypy occurred at high rates for Milo (M = 4.9 responses per minute; range, 0 to 6.6) and at high levels for Morris (M = 76% of session time; range, 18.5% to 99.8%). When matched toys were available noncontingently, stereotypy decreased markedly for both Milo (M = 1.1 responses per minute; range, 0 to 7) and Morris (M = 3%; range, 0% to 32%). By contrast, levels of stereotypy were similar to baseline for Morris in the unmatched-toys condition (M = 69%; range, 22.5% to 96.5%). In addition, rates of toy manipulation (not shown in Figure 2) for Milo (M = 4.5 responses per minute; range, 1.1 to 8.7) and levels of toy contact for Morris (M = 95%; range, 81.8% to 99.5%) were similar to levels of stereotypy displayed by each participant in baseline. By contrast, the levels of toy contact in the unmatched-toys condition conducted with Morris were considerably lower (M = 31%; range, 1.5% to 86%).

The results of Experiment 2 showed that the availability of toys that matched the form of stimulation provided by stereotypy resulted in decreases in both property destruction and stereotypy, whereas unmatched stimuli were only minimally effective with Morris. The matched-toys intervention was highly effective with Morris but less so with Milo, who periodically displayed unacceptable levels of property destruction in this condition. Therefore, in Experiment 3, we evaluated the effects of preventing the presumed response–reinforcer relation through response blocking (i.e., blocking Milo from picking up the materials he typically destroyed), which required that caregivers monitor him more closely.

EXPERIMENT 3

Evaluation of Blocking

Method

Experiment 3 was conducted using a reversal design (ABAB). Each session was 10

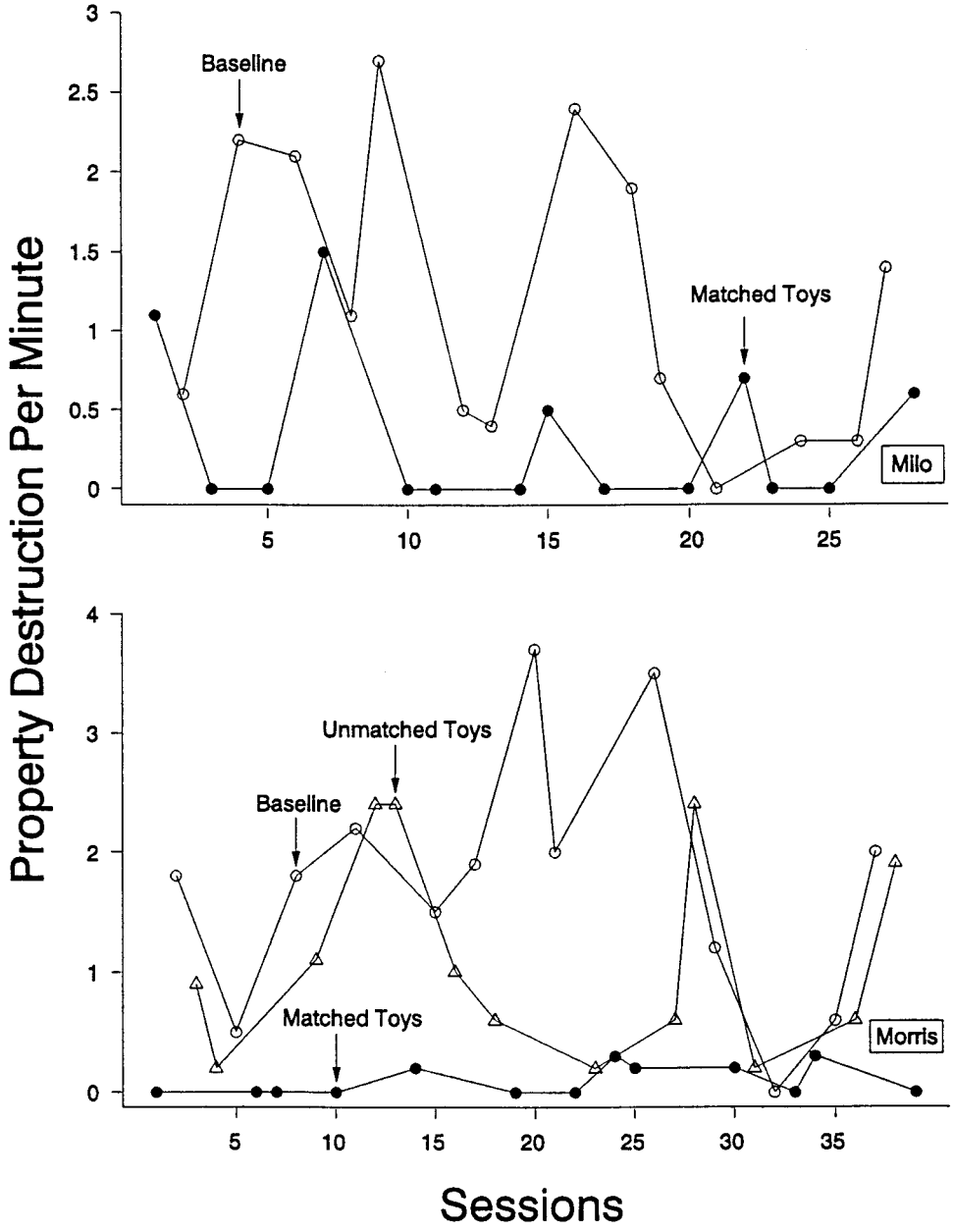

Figure 2. Levels of property destruction during baseline and the matched toys condition for Milo (top panel) and the matched and unmatched toys conditions for Morris (bottom panel).

min in length, and approximately 8 to 10 sessions were completed per day. Sessions were conducted in a room (3 m by 3 m) equipped with a one-way mirror. During baseline, the room was baited with the same plastic items used in Experiments 1 and 2, which were similar to items Milo typically broke at home. The matched toys from Experiment 2 were noncontingently available throughout the session. In addition, a therapist was present in the room, and Milo could obtain brief physical (sitting on the therapist's lap) and verbal (praise) attention by initiating interaction with the therapist.

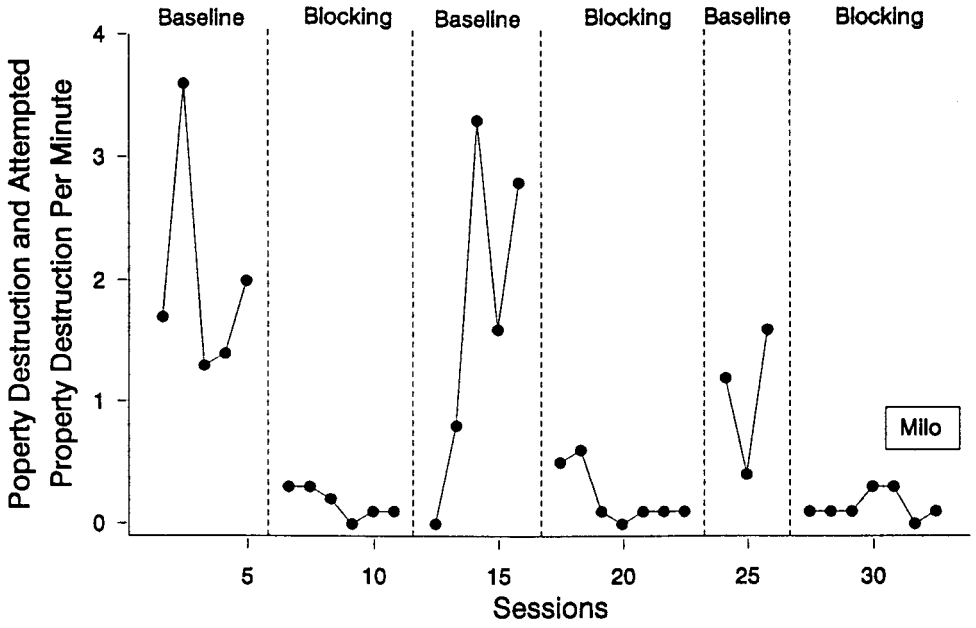

Figure 3. Rates of property destruction (plus attempts) during baseline and the blocking condition for Milo.

Attention was given provided that Milo was not touching any of the plastic items that he typically broke when he initiated interaction with the therapist. Otherwise, there was no programmed consequence for touching or breaking the plastic objects. The blocking condition was identical to baseline except that, when Milo touched one of the plastic objects, the therapist immediately removed the object and directed Milo's hand toward a matched toy.

Results and Discussion

The effects of blocking on property destruction (and attempts) are shown in Figure 3. Attempts (i.e., touching one of the plastic objects) were included in this analysis because the blocking procedure precluded property destruction. Milo displayed relatively high rates of property destruction (M = 0.9 and 0.6 responses per minute) and attempts (M = 1.1 and 1.1 responses per minute) in the first and second baseline phases, respectively. In the third baseline phase, the rates of property destruction (M = 0.6 responses per minute) and attempts (M = 0.5 responses per minute) were somewhat lower. In each blocking phase, there was no property destruction, and attempts decreased to near-zero levels (M = 0.2, 0.2, and 0.1 responses per minute).

During each baseline phase, stereotypy (not shown in Figure 3; M = 2.8, 2.4, and 2.9 responses per minute) occurred at higher rates than did toy manipulation (M = 1.2, 1.6, and 0.5 responses per minute). During blocking, stereotypy was precluded (the plastic materials were removed before Milo could tap them) and toy manipulation (not shown in Figure 3) increased (M = 2.6, 2.5, and 1.4 responses per minute). Thus, blocking property destruction (which prevented its presumed reinforcer, stereotypy) increased manipulation of the toys that matched the presumed function of stereotypy. Finally, it is worth noting that Milo displayed higher rates of property destruction and stereotypy and lower rates of toy manipulation during baseline in Experiment 3 than during the matched-toys condition of Experiment 2,

even though these two conditions were similar. Part of the differences apparent in Figures 2 and 3 is due to the fact that attempted property destruction (picking up objects) is included in Figure 3 but not in Figure 2. However, this explains only part of the difference between the two conditions involving matched toys. It is possible that the effectiveness of matched toys during Experiment 2 was partially due to the novelty of these items, which wore off somewhat in Experiment 3.

GENERAL DISCUSSION

We conducted a series of experiments to evaluate the relation between two aberrant responses, stereotypy and property destruction, and to develop a treatment for the latter response. Results of Experiment 1 showed that property destruction and stereotypy both persisted in the absence of social contingencies during baseline. However, only property destruction decreased when previously destroyed materials were available noncontingently during NCD. Results of Experiment 2 showed that the availability of matched toys (ones that produced sensory consequences similar to stereotypy) reduced both stereotypy and property destruction. In addition, the unmatched but preferred toys evaluated with Morris produced much smaller reductions in stereotypy and property destruction. Finally, the results of Experiment 3 conducted with Milo showed that blocking property destruction reduced this response (and attempts) and also produced a concomitant increase in toy manipulation.

Based on these results and the fact that both responses involved the same articles (hard plastic items for Milo; string-like materials for Morris), we hypothesized that property destruction and stereotypy formed a response chain that was maintained by the sensory consequences of stereotypy. That is, we believe that Milo broke objects to produce preferred articles for stereotypy and then tapped them to produce preferred sensory consequences (presumably the auditory or tactile stimulation produced by tapping). Similarly, Morris ripped material and then manipulated it to produce preferred sensory consequences (presumably the tactile stimulation produced by string manipulation). Results of the three experiments support this response-chain hypothesis in a number of ways.

First, the fact that property destruction and stereotypy persisted in the absence of social contingencies supports the hypothesis that both were maintained by automatic reinforcement. Second, property destruction decreased but stereotypy continued unabated during NCD, presumably because only the latter response was necessary for obtaining the hypothesized terminal reinforcer (i.e., the sensory consequences of stereotypy). Third, within-session analyses from the initial baseline of Experiment 1 also support this interpretation in that the probability of stereotypy increased and the probability of property destruction decreased over the course of a baseline session. However, it should be acknowledged that these within-session trends were much larger and clearer for Milo than for Morris. Fourth, when the hypothesized response–response–reinforcer relation was interrupted in Experiment 3 through response blocking, Milo shifted to another response that produced similar sensory consequences (i.e., manipulation of the matched toys increased). That is, depriving Milo of the materials used for stereotypy appeared to function as an establishing operation that increased the reinforcement value of manipulating the matched toys. Fifth, the fact that matched toys produced larger decrements in property destruction and stereotypy than did unmatched toys in Experiment 2 is also consistent with the hypothesis that the two responses were maintained by

the sensory consequences produced by stereotypy.

Although these findings support our response-chain hypothesis, they do not prove that property destruction and stereotypy were related in this manner or that they were both maintained by the sensory consequences of the latter response. A clear demonstration that access to broken materials functioned as an interim reinforcer for property destruction would require data showing that this response increased when it produced such materials and was extinguished when it did not. This might be accomplished by including a condition with unbreakable baited materials that were otherwise identical to the breakable ones used in these experiments. However, we were unable to find such materials. A clear demonstration that the two responses were maintained by the hypothesized terminal reinforcer would require data showing that both responses were extinguished when stereotypy no longer produced the putative sensory consequences. However, we were unable to conceive of a way to separate stereotypy from the sensory consequences it automatically produced.

A number of investigations have shown that matched stimuli may compete effectively with the stimulation automatically produced by aberrant responses (e.g., Favell et al., 1982; Kennedy & Souza, 1995; Piazza et al., 1998). However, other studies have shown that stimuli identified via a preference assessment (unmatched but preferred stimuli) also may compete effectively with automatically maintained responses (e.g., Ringdahl et al., 1997; Shore et al., 1997; Vollmer, Marcus, & LeBlanc, 1994). If both approaches produce equivalent effects on aberrant behavior, one would generally use unmatched preferred stimuli because they may be more likely to occasion socially desirable behaviors (e.g., appropriate play), whereas matched stimuli are more likely to occasion stereotypic behavior. We completed two preference assessments in our attempt to identify highly preferred unmatched stimuli that would effectively compete with property destruction and stereotypy. However, the results of Experiment 2 for Morris showed that matched stimuli were more effective than unmatched preferred stimuli for reducing these aberrant responses. These results suggest that it may be important to include both matched and unmatched stimuli in preference assessments when attempting to identify stimuli that compete with stereotypy.

Matched stimuli may sometimes be more effective than unmatched stimuli because they remove the specific establishing operation for aberrant behavior. For example, if stereotypy is maintained by its auditory consequences, interacting with matched stimuli should eventually produce satiation for similar auditory stimulation, which should lower motivation for both the alternative response and stereotypy. By contrast, interacting with unmatched visual stimuli should lower motivation primarily for the alternative response, and individuals may display stereotypy at times when auditory stimulation is momentarily preferred to visual stimulation.

Finally, the current findings may be noteworthy because they illustrate how one aberrant response may be reinforced and maintained by the consequences of another aberrant response. Charlop, Kurtz, and Casey (1990) and Sugai and White (1986) showed that access to stereotypic behavior can be manipulated by the experimenter and used programmatically to reinforce appropriate target responses (e.g., compliance). The current investigation shows how similar response–response relations may develop automatically in the natural environment when an individual is alone. Future research should focus on identifying other response–response relations that may help to explain

why topographically distinct aberrant responses often co-occur.

One limitation of the matched-toys intervention was that toy manipulation for Milo and toy contact for Morris were topographically similar to stereotypy (i.e., the participants engaged in self-stimulation with toys rather than with materials they had previously destroyed). However, it should be noted that property destruction was the primary target response for which these individuals were admitted to the hospital. Furthermore, property destruction occurred in the participants' homes primarily when they were alone or minimally supervised (e.g., when the caregiver was busy in another room or asleep). Thus, the matched-toys intervention was designed to decrease property destruction at times when the caregivers were unable to implement other contingencies (e.g., differential reinforcement schedules, response blocking). It was highly successful with Morris (i.e., a 94.7% reduction in the rate of property destruction) but somewhat less so with Milo (i.e., a 74% reduction). Teaching the participants to interact with materials in a more socially desirable manner was a goal that was addressed during classroom instruction. Future research should evaluate the extent to which more desirable responses that are taught and socially reinforced during instructional activities generalize to situations in which the client is alone and can freely choose between this newly acquired response and stereotypy.

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STUDY QUESTIONS

1. According to the authors, what are three reasons why two responses may be positively correlated?

2. Describe the destructive and stereotypic behaviors of both participants.

3. How did the results of the Experiment 1 support the authors' hypothesis about the relationship between participants' destructive and stereotypic behaviors, and what additional information was gained by examining the data on within-session responding?

4. How did the authors define and identify "matched" and "unmatched" stimuli?

5. The authors suggested that the different results obtained for Morris during the two leisure-item conditions in Experiment 2 were due to the fact that matched stimuli were present in one condition, whereas unmatched stimuli were present in the other condition. What alternative explanation could account for the differences in levels of stereotypy and property destruction that were observed in the two conditions?

6. How did the results of Experiment 3 provide additional support for the authors' hypothesis about the relationship between destructive and stereotypic behaviors?

7. Which account of response covariation mentioned in the introduction best corresponds with the authors' description of property destruction and stereotypy as a response chain?

8. What was the noted advantage and limitation of using matched stimuli to reduce a target behavior?

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